Chapter 3

Retrospective study on the treatment outcome of surgical closure of oroantral communications.

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Abstract

A retrospective cohort study concerning the surgical closure of oroantral communications (OACs) was carried out to facilitate a comparison between the treatment outcomes of conventional surgical treatment, and new strategies for closure of OACs. The data were statistically analyzed to gather insight into possible predictor variables of a recurrent OAC.

A cohort of all patients treated for an OAC in 2004 - 2008 was reviewed. The recorded data included patient age and gender, location and duration of the OAC, method of removal of the (pre)molar, presence of maxillary sinusitis, disturbed wound healing, and the surgical treatment method. Data analysis included descriptive and multivariate logistic regression analysis with recurrence of the OAC as the outcome variable.

A total of 308 patients were included in the sample, of which 28 patients (9.1%) required a second intervention to repair the OAC. Of these 28 patients, 4 patients needed a third intervention, making the total number of recurrent OACs 32 (10.4%). In most cases (60.7%), a buccal advancement flap ad modum Rehrmann was used to close the perforation. Multivariate regression analysis showed a 15 times higher risk of a recurrence in case of a maxillary sinusitis at the follow-up appointment.

The overall results of the study showed that in about 1 out of 10 patients the OAC recurs and requires a second intervention after surgical closure. New strategies should therefore result in an equal or better treatment outcome in order to be considered a suitable treatment option.

Furthermore, it was demonstrated that the presence of a maxillary sinusitis at the follow-up appointment is an important determinant of the treatment outcome of OAC repair.

Introduction

Oroantral communications (OACs) are seen mostly after extraction of the maxillary first and second molars (1-4). The incidence of OACs reported in the literature varies to a great extent, probably because some authors report on the number of OACs associated with the whole upper lateral segments, where others report solely on the incidence of OACs after third molar removal. For example, Rothamel et al (5) found an incidence of OACs of 13 % after removal of maxillary third molars. Bodner and co-authors (6) found an incidence of 5 % after removal of premolars and molars in the maxilla.

Immediate closure of OACs, preferably within 24 - 48 hours, is recommended to minimize the risk of maxillary sinusitis and the development of a fistula (7). Surgical closure still seems to be the treatment of choice to close oroantral communications, although numerous alternative techniques have been proposed (8;9). Primary suture of the gingiva is used for simple closure of small OACs. However, a study by von Wowern (1) showed that primary suture resulted in a relatively high number of failures. Therefore, mucosal closure using a buccal mucoperiosteal flap or a palatal rotational flap seems preferable, especially for larger OACs. The buccal fat pad (BFP) has also proven to be suitable for closure of OACs, especially in case of failure of the buccal or palatal flap. Nevertheless, some authors recommend the use of the BFP as a first option for closure of (larger) OACs (10;11).

In the literature, success rates for these most commonly used surgical techniques have been published (4;10;12-15). However, to our knowledge, little information can be found in the literature concerning the (general) complication rate associated with surgical closure of OACs, as indicated by recurrence of the OACs. The only information on this matter is provided by Abuabara and co-authors (11) and mostly involves closures by means of primary suture or the buccal fat pad. No statistical analyses were performed in that study. To facilitate a comparison between the treatment outcomes of conventional surgical treatment and new and upcoming strategies for closure of OACs, such information is important. Therefore, we performed a retrospective study on the complication rate after surgical closure of OACs. Data obtained were statistically analyzed to gather insight into possible predictor variables of a recurrent OAC.

Patients and methods

Study design and study sample

All records of patients with a documented diagnosis of an OAC, treated in the period 2004-2008 at the department of Oral and Maxillofacial Surgery, University Medical Centre Groningen, Groningen (the Netherlands) were reviewed in this retrospective cohort study. This review resulted in a total number of 323 patients. We excluded fif-

teen patients because of incomplete data making further analysis impossible. The final study sample included 308 patients.
The OAC was confirmed by inspection and both nose and mouth blowing. We considered the first treatment the treatment performed at our clinic. In other words, in case closure of the OAC had been attempted by the general dentist, this was not counted as the first treatment.

No antibiotics or decongestants were prescribed beforehand. However, OACs existing > 24 h, or OACs with evident non purulent antral infection, were closed and additionally treated with antibiotics and decongestives. In case of purulent sinusitis, antral irrigation with a saline solution was carried out until the fluid draining from the nose and OAC was clear for at least 2 consecutive days. In addition to closure, both antibiotics and decongestants were prescribed in these cases. These treatments are in accordance with the guidelines of the Dutch Society for Oral and Maxillofacial Surgery.

All patients were given instructions to avoid pressure on the OAC, such as nose blowing, and to take postoperative analgesics (ibuprophen or paracetamol) when necessary. Each patient was evaluated 10-14 days after closure of the OAC and remaining sutures were removed. Further follow-up appointments were scheduled when necessary.

For all patients the following data was collected: patient gender and age, site of the OAC, removal method (simple extraction or surgical removal), duration of the OAC, presence of maxillary sinusitis at the follow-up appointment, disturbed wound healing, number of recurrences, and the treatment strategy.

In case of a small and deep OAC, primary suture was carried out. In other cases, methods like a trapezoidal buccal advancement flap ad modum Rehrmann (16), split thickness palatal rotation flap or buccal fat pad were applied. Spongostan® (Johnson & Johnson medical bv, Amersfoort, the Netherlands), an absorbable haemostatic gelatin sponge, in combination with suturing of the gingiva was also used in a few patients.

Statistical analysis

Descriptive statistics were computed for each variable. Univariate logistic regression analyses were performed for the predictor variables on the outcome variable (recurrence of OAC). Variables with a P-value below 0.15 were used in the further development of the effect model. Multivariate logistic regression (entry 0.04, removal 0.05, backward conditional) was used to find independent risk factors. All analyses were performed using the Statistical Package for Social Sciences (SPSS for Windows, version 16.0).

Results

All recorded variables in this study were listed separately for both the patient group with OACs as a whole (n = 308) and for the patient group with a recurrent OAC.

The first attempt to accomplish closure of the OAC was unsuccessful in 28 patients (9.1 %), meaning that a second intervention was necessary. However, in four of these patients, a third attempt was needed to close the perforation, making the total number of recurrences 32 (10.4 %).

The ratio of men to women in the whole patient cohort was roughly 2/3 to 1/3 (194 men, 114 women). The mean age of the patients was 43 years (range 8 to 78). The highest incidence of OACs was seen after the third decade of life, with almost equal numbers for the fourth and fifth decades (Table 1). Most OACs were located at the first, second and third molars (Table 2), with nearly equivalent numbers for the left and right maxilla. The (pre)molars were simply extracted by forceps in 137 cases, whereas surgical removal was needed in 155 cases. In the group with a recurrent OAC, extraction by forceps and surgical removal were performed on an almost equal basis.

In 50 of the 308 patients (16.2%), maxillary sinusitis was diagnosed clinically and/or radiographically at the first follow-up appointment (Table 3). Of the 28 patients with a recurrent OAC, 19 (67.9 %) were diagnosed with a maxillary sinusitis at this stage. Disturbed wound healing was documented in 33 patients (10.7 %), of whom 9 developed a recurrent OAC.

Table 1 Age distribution of 308 patients with an OAC.

Age (yrs)	No. of patients (%)	No. of patients with recurrent OAC (%)
< 20	5 (1.6)	0 (0)
20-29	54 (17.5)	4 (14.3)
30-39	71 (23.1)	5 (17,9)
40-49	76 (24.7)	8 (28.6)
50-59	65 (21.1)	8 (28.6)
60-69	25 (8.1)	2 (7.1)
≥ 70	12 (3.9)	1 (3.6)
Total	308 (100)	28 (100)

Table 2 Regional distribution of the OACs.

Location OAC	No. of OACs (%)	No. of recurrent OACs (%)
first premolar	4 (1.3)	0 (0)
second premolar	16 (5.2)	1 (3.6)
first molar	100 (32.5)	8 (28.6)
second molar	90 (29.2)	12 (42.9)
third molar	93 (30.2)	7 (25.0)
unknown	5 (1.6)	0 (0)
Total	308 (100)	28 (100)

The recurrent OACs were reported mostly within the first 2 weeks after closure (75 %). In the other 7 patients, the recurrence was diagnosed after a period of 2-4 weeks.

The duration of the OAC was longer than 24 hours in almost 36 % of the patients with a recurrent OAC, which is twice as many as in the patient cohort as a whole (Table 4).

The buccal advancement flap was the first choice to accomplish closure of the OAC in most patients (60.7%), followed by primary suture in case of a small OAC (Table 5). In 72 patients, it was not exactly clear which treatment method was used.

The OACs that later required a second intervention were all closed with a buccal flap the first time, except in 2 cases (primary suture). The second attempt to close these perforations was carried out with either a buccal flap (42.9%), or the buccal fat pad in combination with a buccal flap (25%) in most cases (Table 6). Strikingly, the palatal flap was carried out only once after failure of the first intervention, and twice after failure of the second intervention. In 2 patients, an acrylic plate was fabricated to cover the OAC, resulting in successful secondary healing.

The overall success percentage of the buccal flap was 87.2%. The palatal flap was used only in 3 cases, all with success. Closure with primary suture failed twice, resulting in a success percentage of 97%.

The univariate regression analysis revealed statistically significant associations between recurrence of the OAC and closure with a buccal flap (P = 0.008), presence of maxillary sinusitis (P = 0.000) and disturbed wound healing (p = 0.001) (Table 7). In the final multivariate model the variable disturbed wound healing was lost because of a correlation between the presence of maxillary sinusitis and disturbed wound healing (r = 0.20, P = 0.000). No significant associations were found for the other variables.

Based on the multivariate analysis, the presence of maxillary sinusitis at the follow-up appointment is associated with a 15 times higher risk of a recurrent OAC (Table 7).

Table 3 Maxillary sinusitis diagnosed at the follow-up appointment, 10-14 days after closure.

Maxillary sinusitis	No. of patients (%)	No. of patients with recurrent OAC (%)
Yes	50 (16.2)	19 (76.9)
No	258 (83.8)	9 (32.1)
Total	308 (100)	28 (100)

Table 4 Duration of the OACs

Time between occurrence and closure of OAC	No. of OACs (%)	No. of recurrent OACs (%)
≤ 24 hrs	245 (79.5)	18 (64.3)
> 24 hrs	52 (16.9)	10 (35.7)
Unknown	11 (3.6)	0 (0)
Total	308 (100)	28 (100)

Table 5 Overview of the used treatment methods for the patient cohort as a whole.

Treatment method	No. of OACs
Buccal flap	187 (60.7)
Palatal flap	3 (1.0)
Primary suture	28 (9.0)
Buccal fat pad	4 (1.3)
Buccal fat pad and buccal flap	5 (1.6)
Spongostan®	9 (2.9)
Unknown	72 (23.4)
Total	308 (100)

Table 6 Overview of the used treatment methods for the patient group with a recurrent OAC.

Treatment method recurrent OACs	1st intervention	2nd intervention	3rd intervention
Buccal flap	24	12	0
Palatal flap	0	1	2
Primary suture	2	2	0
Buccal fat pad	0	2	0
Buccal fat pad and buccal flap	0	7	0
Buccal and palatal flap	0	1	0
Acrylic plate	0	1	1
Bone transplant and buccal flap	2	2	1
Unknown	0	0	0
Total	28	28	4

Table 7 Logistic regression on predictor variables and recurrence of OAC. Abbreviation: CI, confidence interval.

Univariate model		
Variable	**Odds Ratio (95.0 % CI)**	**P**
Age	1.012 (.99-1.04)	.374
Gender (male vs. female)	.539 (.22-1.31)	.173
Extraction vs. surgical removal	.683 (.31-1.51)	.347
Location OAC	.956 (.88-1.03)	.263
Duration OAC (≤ 24 hrs vs. > 24 hrs)	1.659 (.67-4.14)	.277
Primary suture	.751 (.17-3.35)	.708
Buccal flap	4.307 (1.46-12.74)	.008*
Palatal flap	.000 (.00-.)	.999
Buccal fat pad	.000 (.00-.)	.999
Buccal fat pad and buccal flap	.000 (.00-.)	.999
Maxillary sinusitis (yes vs. no)	13.122 (5.53-31.12)	.000*
Disturbed wound healing (yes vs. no)	4.725 (1.85-12.04)	.001*
Final multivariate model		
Variable	**Odds Ratio (95.0 % CI)**	**P**
Buccal flap	4.982 (1.57-15.84)	.000*
Presence of maxillary sinusitis	15.127 (6.22-36.79)	.007*

Discussion

Gender, age distribution, and location of the OACs in the 308 patients in this study were similar to those in previous studies (4;5;11;15;17), although the incidence of OACs in the third molar region is higher in our group. As in the study by Abuabara and coauthors (11), the latter can be explained by the relatively high number of third molar removals in our clinic.

In our study, the buccal sliding flap was the treatment of choice in most cases. The success percentage of the buccal flap was 87%, which is in proportion to earlier studies. In the series of De S. Amaratunga (17) for example , 86 % of the 44 OACs were closed uneventfully with a buccal flap, although contrary to our study, all patients were treated with antibiotics for 1 week. Others report on a success rate of more than 90 % for the buccal flap (15;18).

Closure was accomplished with primary suture in 28 cases, of which 2 failed on the first attempt (7 %), which is exactly the same percentage as von Wowern found (1).

Strikingly, the palatal flap was used only 3 times in our patient cohort. This might be explained by the presumed higher level of postoperative complaints due to secondary healing of the donor area. Also, closing an OAC in the third molar area is more difficult with a palatal flap as a result of the limited rotation of the pedicle.

The buccal fat pad was used 9 times in the first attempt to close the OAC, all of which healed uneventfully. In most of these cases the BFP was covered as much as possible by a buccal flap because the buccal fat pad by itself may not always provide adequate sealing due to its fragile and lobulated structure.

Antibiotics are not prescribed beforehand in the Netherlands when closing OACs. However in other countries, antibiotics seem to be prescribed on a more routine basis. A number of authors recommend the use of antibiotic prophylaxis for OAC repair (17-19). In our study, 50 patients were diagnosed with a maxillary sinusitis, based either on clinical signs, radiographic signs or both. In 19 of these 50 patients the OAC recurred. The statistical analysis also showed that the presence of a maxillary sinusitis at the follow-up appointment is associated with a higher risk of a recurrent OAC. However, these numbers do not seem to justify antibiotic prophylaxis for every OAC closure in our opinion. Instead, to prevent higher risk of a recurrent OAC, extra attention should be focused on detecting maxillary sinusitis with the emphasis on the clinical examination. Secondly, as demonstrated by von Wowern (20), radiographic examination should take place only to support and further examine clinical findings instead of using it as a diagnostic tool, as false positive radiographs in cases with no clinical signs of maxillary sinusitis are quite often seen (22-63%).

In our study the success percentage of the buccal flap was 87 %. However, the significant association between closure with a buccal flap and recurrence of the OAC (P = 0.00), suggests that closure with a buccal flap gives rise to an almost 5 times higher risk of a recurrent OAC. This association is probably influenced by the variable "unknown", which represents the quite high number of closures for which the method was not documented (n = 72). In this group, closure was probably also accomplished with a buccal flap for most patients, considering the high number of buccal flap closures in the patient cohort as a whole. Therefore, this association should not be interpreted as such.

As Killey and Kay (4) stated, the buccal flap can be considered a straightforward and reliable method for repair of OACs, which is applicable in practically all situations. Nevertheless, the technique should always be performed with care, especially because the buccal flap does not contain a large vessel like the palatal flap. Because of this, vascularization of the flap might be compromised after suturing it across the defect. Suturing should therefore be tension free and precise to prevent leakage and postoperative breakdown of the flap. Lastly, the attending physician should not opt too routinely for a buccal flap procedure only, as in some cases repair with both a buccal flap and the buccal fat pad may result in a better treatment outcome.

This study was performed retrospectively. Because of this, information that might have been contributing could not always be retrieved. For example the documentation of the noxious habits of the patient cohort was unsatisfactory and therefore not included in the analysis. Also, the method of OAC repair was not explicitly documented in all cases. However, because of the large patient cohort we believe that the study outcome is reliable and representative.

The overall results of the study showed that in about 1 out of 10 cases, the OAC

recurs and requires a second intervention. This success percentage of 90% seems satisfactory, keeping in mind that the last 10 % was also treated with success in the end. New and upcoming strategies should therefore result in an equal or better treatment outcome in order to be considered a valuable alternative treatment option.

Also, it became clear that the presence of maxillary sinusitis is associated with a higher risk of a recurrent OAC. The recurrences documented in this study were mostly seen within 1-2 weeks after closure.

There is no such thing as the best treatment method for OACs because as other authors state, multiple aspects have to be taken into account in each case when deciding which method is to be used. For example when the patient is edentulous, a palatal flap might be preferred to avoid the risk of a permanently lowered buccal sulcus depth. Other important aspects are the site of the OAC, its size, the duration of the OAC, and, as clearly demonstrated in this study, the presence of a maxillary sinusitis.

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